ARITHMETIC.

Conducted by B. F. FINKEL, Kidder, Missouri. All contribution to this department should be sent to him.

6. Proposed by B. F. FINKEL, Professor of Mathematics in Kidder Institute, Kidder, Missouri.

What is the volume of a regular pantagonal pyramid, each side of whose base is 10 feet and the altitude 20 feet?

I. Solution by P. S. BERG, Apple Creek, Ohio; J. A. CALDERHEAD, Limaville, Ohio; Professor H. C. WHITAKER, Philadelphia, Pennsylvania; and H. W. HOLYCROSS, Pottersburg, Ohio.

Area of base$=\text{side}^2\times\frac{5}{4}\sqrt{1+\frac{2}{5}\sqrt{5}}.$

Area of base$=10^2\times1.7204774=172.04774$ sq. ft.

$\therefore$ Volume of pyramid$=\dfrac{172.04774\times20}{3}=1146.985$ cu. ft.

II. Solution by F. A. SWANGER, Professor of Mathematics in the State Normal School, Kirksville, Missouri.

$r=\frac{1}{4}\left(\frac{a}{2}(\sqrt{5}+1)\sqrt{10+2\sqrt{5}}\right)$ where r is apothem and a the side of a regular pentagon. Reducing this expression, the constant ratio between the apothem and side of a regular 5-side may be found to be $.6882=\frac{r}{a}$; $r=a\times.6882$. Whence in above problem $r=10\times.6882=6.882$. Now area of a regular n-side=the product of its apothem (r) and $\frac{1}{2}$ its perimeter.

$\therefore$ Base of pentagon$=25\times6.882=172.050$. But volume of a pyramid equals $\frac{1}{3}$ $B\times H$ (altitude).

$\therefore$ $V=\frac{20}{3}\times172.05=20\times57.35=1147.00$.

Neatly solved by *A. L. Foote. G. B. M. Zerr*, and *I. L. Beverage.*

7. If an article had cost me 10% less, the gain would have been 12% more; what was the gain per cent?—[Selected from *Brooks' Higher Arithmetic.*]

Solution by B. F. FINKEL, Professor of Mathematics in Kidder Institute, Kidder, Missouri.

II.

1. *100%* = selling price, and
2. 100% = actual cost. Then
3. *100%* − 100% = actual gain.
4. 100% − 10% = 90% = supposed cost. Then
5. *100%* − 90% = gain on the condition that the article cost 90%.
6. 1. 90% = 100% of itself.
   2. 1% = $\frac{1}{90}$ of 100% = $1\frac{1}{9}$%, and
   3. *100%* − 90% = (*100*−90) times $1\frac{1}{9}$% = $\frac{10}{9}\times$ *100%* − 100% = conditional gain%.
7. $\frac{10}{9}\times$ *100%* − 100% − (*100%* − 100%) = $\frac{1}{9}\times$ *100%* = difference.
8. 12% = difference.
9. $\therefore$ $\frac{1}{9}\times$ *100%* = 12%.
10. *100%* = 9 × 12% = 108%, the selling price in terms of the cost price.
11. $\therefore$ 108% − 100% = 8% = the gain.

III. $\therefore$ The gain is 8%.

Also solved by *John T. Fairchild, G. B. M. Zerr, A. L. Foote, H. C. Whitaker, H. W. Holycross, I. L. Beverage.*

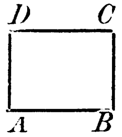
8. Proposed by EARL D. WEST, West Middleburg, Logan County, Ohio.

The number of men in a side rank of a solid body of militia is to the number of men in the front rank as 2 is 3; if the length and breadth be increased so as to

number each 4 men more, the whole body will then contain 2320 men. How many men in the militia?

I. Solution by Professor G. B. M. ZERR, Principal of Schools, Staunton, Virginia.

Let $ABCD$ represent the body of militia.



Then AB: $CB=3:2$ $\therefore$ $2\,AB=3\,CB$, $AB=\frac{3}{2}\,CB$

Now $(CB+4)(\frac{3}{2}\,CB+4)=2320$.

$\therefore$ $CB^2+\frac{20}{3}CB=1536$.

$CB=36$, $AB-\frac{3}{2}CB=54$.

The required number $=36\times54=1944$ men.

II. Solution by P. S. BERG, Apple Creek, Ohio.

1. If 16 men be taken from 2320 men the remainder, 2304 men, may be regarded as standing on 6 squares + 5 rectangles each 4 wide and just as long as each of the six squares.

2. $\therefore$ 1 square + 1 rectangle $\frac{10}{3}$ wide $=2304\div6=384$.
3. $\therefore$ 1 square + 2 rectangles $\frac{5}{3}$ wide $=384$.
4. $\therefore$ Completed square $=384+\frac{25}{9}=386\frac{7}{9}$.
5. $\therefore$ Side of complete square $=19\frac{2}{3}$.
6. $\therefore$ Side of original square $=19\frac{2}{3}-1\frac{2}{3}=18$.
7. $\therefore$ Side rank $=18\times2=36$ men.
8. $\therefore$ Front rank $=18\times3=54$ men.
9. $\therefore$ Total number of men $=54\times36=1944$.

Solved in a similar manner by *J. A. Calderhead, H. C. Whitaker*, and *I. L. Beverage*. *A. L. Foote* gave an excellent solution by Algebra.

PROBLEMS.

18. Proposed by L. B. HAYWARD, Superintendent of Schools, Bingham, Ohio.

In a circle whose radius is 6, find the area of the part between parallel chords whose lengths are 8 and 10, both being on the same side of the center.

17. Proposed by H. W. HOLYCROSS, Superintendent of Schools, Pottersburg, Union County, Ohio.

A gentleman owns a circular farm, and if three circles of equal area and as large as possible be drawn within it, the circular area in the center of the farm will contain one acre; what is the area of the circular farm?

16. Proposed by EARL D. WEST, West Middleburg, Logan County, Ohio.

How many stakes can be driven down upon a space 15 feet square allowing no two to be nearer each other than $1\frac{1}{2}$ feet, and how many allowing no two to be nearer than $1\frac{1}{4}$ feet?

15. Proposed by O. S. KIBLER, Superintendent of Schools, West Middleburg, Logan County, Ohio.

Supposing the town A to be 30 mi. from B, B 25 mi. from C, C 20 mi. from A, where must a house be erected to be equally distant from each of the towns?

14. Proposed by Professor G. B. M. ZERR, A. M., Principal of Schools, Staunton, Virginia.

A bank by discounting a note of 7% receives for its money a discount equivalent to $7\frac{3}{4}$% interest. How long must the note have been discounted before it was due?

Solutions to these problems should be received on or before May 1st.